Preliminary Drainage Analysis
for
LOS PORTALES PROJECT
AT APN 031-351-10

City of Santa Barbara, California

February 2007

SUBMITTAL TO:	City of Santa Barbara
CLIENT:	Bermant Development Company
PREPARED BY:	Penfield & Smith 111 East Victoria Street Santa Barbara, California 93101 (805) 963-9532
WORK ORDER NO.:	15783.04
PROJECT ENGINEER:	Wayne F. Fitch, P.E.

PURPOSE OF REPORT

The purpose of this report is to describe the existing and proposed site drainage conditions and estimate the amount of drainage runoff being transmitted through the project site for a 25-year storm event.

LOCATION

The Los Portales project is located at 535 E. Montecito Street on a 1.78-acre parcel at the northwesterly intersection of Calle Cesar Chavez and Montecito Streets in the City of Santa Barbara. The property is Assessor's Parcel Number (APN) 031-351-10.

EXISTING SITE CONDITION

The project site is a vacant lot with uncultivated ground. The majority of the site is sloped from the north towards the southwest. The remaining portion of the site slopes toward the northeast.

This site is within a Zone A 100-year flood plain in accordance with the Flood Insurance Rate Map (FIRM) dated September 30, 2005 (Map Number 06083C1391F) published by the Federal Emergency Management Agency (FEMA) (see Attachment A).

The Base Flood Elevation (BFE) for the site is 10.7', in accordance with the data provided by the City of Santa Barbara Floodplain Coordinator (see Attachment A).

In 2001, Penfield & Smith prepared the "Laguna Drainage System Design Study" for the City of Santa Barbara (see Attachment B). This study showed that the Laguna Channel Drainage System "collects runoff from over 1800 acres within the City of Santa Barbara." The drainage area is generally bounded by Garden Street to the west, Salsipuedes Street to the east and U.S. Highway 101 to the south. The Los Portales project site is located at the south end of the Laguna Channel Drainage System. As stated in the 2001 Drainage Study, since development within the drainage area began in the late 19th century with portions of the area only a few feet above high tide ocean level, flooding has occurred.

Figure 2 of the "Laguna Drainage System Design Study" shows the approximate water surface elevation at 9.0' during the 1995 flood event. The shaded area on Figure 2 shows that approximately half of the Los Portales project site was flooded during this event. The existing street elevation at the intersection of Calle Cesar Chavez and Montecito Streets is approximately 9.5'. During major storm events, similar to what

occurred in 1995 and 1998, the Laguna Channel and the upstream existing storm drain system reaches its capacity and causes the subsequent streets to "serve as overflow channels."

PROPOSED SITE CONDITION

The proposed site development includes six multi-story buildings and garages with driveway aisles and landscaped paths between them. There are two (2) driveways along Calle Cesar Chavez to allow entry to the site. There is one driveway entrance from the adjacent westerly parking lot. The proposed lowest building finish floor elevation will be set at 11.37'. The proposed lowest front of garage finish grade elevation is 10.80'.

The project proposes to direct approximately half of the storm water runoff to Calle Cesar Chavez and the other half to Montecito Street. The runoff will be collected on site and be transmitted to the street via curb outlet drains. If these small drains become blocked or if the capacity is exceeded, runoff will pond and escape over the sidewalks and curbs to the street gutters, which are well below the building and garage finish floor elevations.

METHOD OF ANALYSIS

The drainage peak runoffs for the 25-year storm event were calculated for the sites' pre-development and post-development conditions. The drainage analysis was prepared according to the current Santa Barbara County Flood Control Design Standards. The hydrology calculations used the Santa Barbara County Flood Control and Water Conservation District Rational-XL program. The XL program references the Rational Method (Q=ciA), in which "c" is the site runoff coefficient; "i" is the a rainfall intensity in inches per hour (in/hr); and "A" is the drainage area in acres.

RESULTS

In utilizing the Rational-XL program, the agricultural land use was used for the Pre-Development condition; while the commercial land use was used for Post-Development condition.

"c"-value for 25-year storm event:

For Pre-Development Site:	c = 0.68
For Post-Development Site:	c = 0.74

"i"-value for 25-year storm event: 3.18 in/hr

Pre-Development Condition (see Attachment C):

For 25-year runoff:

- Northerly and easterly site area (flow to Calle Cesar Chavez): A=0.11 acre

  Q=c*i*A Q= (0.68)(3.18)(0.11) = 0.24 cfs

- Majority of the site (flow to Montecito Street): A=1.67 acres

  Q=c*i*A Q= (0.68)(3.18)(1.67) = 3.61 cfs

  Total site runoff: Q = 3.85 cfs
  (see Attachment C, Pre-development drainage map and Pre-development hydrology calculations)

Post-Development Conditions (flow to Montecito Street) (see Attachment D):

For 25-year runoff:

A=1.78 acres

Q=c*i*A Q= (0.74)(3.18)(1.78) = 4.19 cfs

Total site runoff: Q = 4.19 cfs
(see Attachment D, Post-development drainage map and Post-development hydrology calculations)

The total difference of the 25-year storm runoff between the pre- and post-development conditions is 0.34 cfs. This represents a 0.03% (0.34/1,250 cfs) runoff increase for the entire Laguna Channel watershed, which is an insignificant increase (see Attachment B).

CONCLUSIONS

Storm water Quantity:

The increase in surface runoff for the site is 0.34 cfs which represents an increase of 0.03% to the entire Laguna Channel watershed. The Los Portales project site is located at the downstream end of the Laguna Channel Drainage System. During our analysis, we have reviewed the feasibility of constructing on-site detention to withhold the increased runoff, and concluded that detention devices will have no impact on the peak flow of the Laguna Channel Drainage System due to the existing local ponding that occurs upstream from U.S. Route 101. The flooding condition on and around the project site is caused by the inadequate ability of the downstream Laguna Channel Drainage system to conduct flows to the Pacific Ocean.

ATTACHMENT A

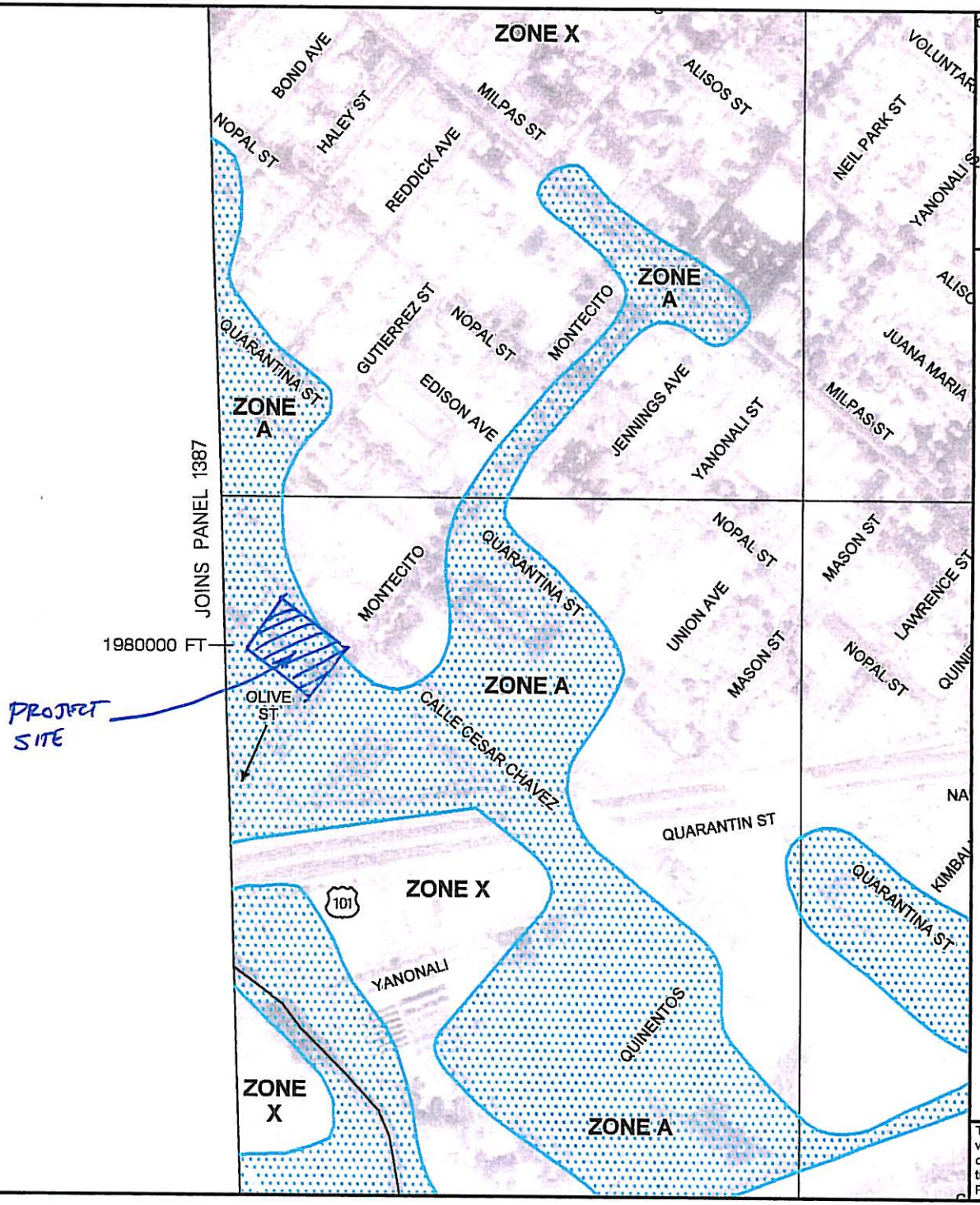
- **FLOOD INSURANCE RATE MAP (FIRM) FOR PROJECT SITE**

- **CITY BASE FLOOD ELEVATION (BFE) DETERMINATION**

onal Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET



NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1391F

FIRM

FLOOD INSURANCE RATE MAP

SANTA BARBARA COUNTY, CALIFORNIA AND INCORPORATED AREAS

PANEL 1391 OF 1835

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SANTA BARBARA, CITY OF	060335	1391	F
SANTA BARBARA COUNTY	060331	1391	F

Notice to User: **The Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06083C1391F

EFFECTIVE DATE
SEPTEMBER 30, 2005

Federal Emergency Management Agency

City of Santa Barbara
Community Development Department
www.ci.santa-barbara.ca.us

RECEIVED
MAR 0 3 2005
BY:

1578303

SANTA BARBARA CITY BASE FLOOD ELEVATION (BFE) DETERMINATION

Date: February 17, 2005

BLD 2004-03097

Site Address: 535 E Montecito

APN: 031-351-010

Contact Person: Detlvet Peikert or Steve Appleton
401 E Carrillo Street
Santa Barbara, Ca. 93101

Telephone: (805) 963-8283
Fax: (805) 963-8184

Director's Office
Tel: 805.564.5502
Fax: 805.564.5506

Building & Safety
Tel: 805.564.5485
Fax: 805.564.5478

Housing & Redevelopment
Tel: 805.564.5461
Fax: 805.564.5477

Planning
Tel: 805.564.5470
Fax: 805.897.1904

630 Garden Street
PO Box 1990
Santa Barbara, CA
93102-1990

Flood Insurance Rate Map (FIRM) Data:

Community Number:	**060335**	FIRM Index date:	**Dec 3, 1991**
Panel Number & Suffix:	**0005D**	Panel date:	**Dec 3, 1991**
FIRM Zone(s):	**A**	Panel revised date:	**Jan 15, 2004**
Structure #1:		Commercial Mixed Use Residential Accessory	
	BFE:	**8.1 NGVD'29**	**10.7 NAVD'88**
Other Structures:		Separate BFE(s) required for each structure	
	BFE:	**xxx.x NGVD'29**	**xxx.x NAVD'88**

***Flood Insurance** is required for any structure whose site is located in a Special Flood Hazard Area (SFHA). Flood insurance is not required for 'X' & shaded 'X' zones.

***Building Permits** are required before any new work, addition, or remodeling of structures in a SFHA (City of Santa Barbara Municipal Code MC 22.24).

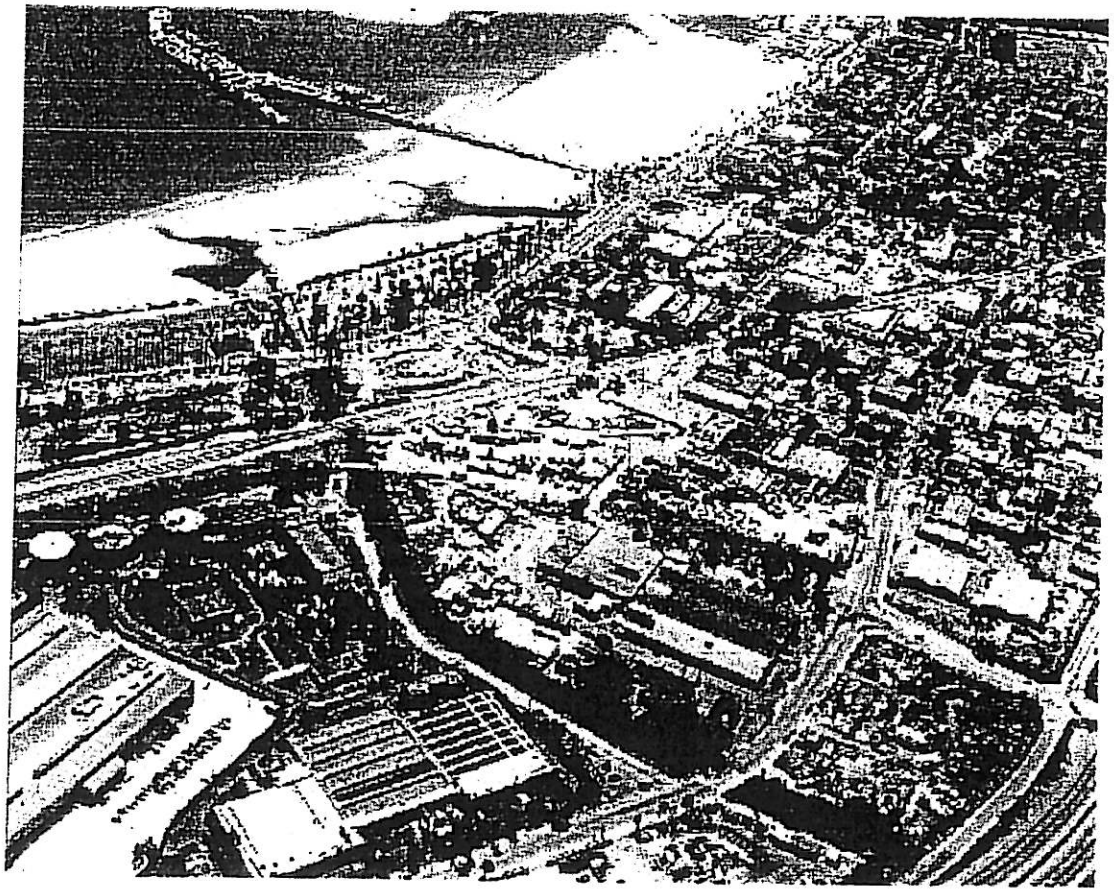
***Contact Building & Safety** for special construction design criteria & or exemptions.

Chris Short, Floodplain Coordinator & Senior Plans Examiner
630 Garden Street
Santa Barbara, Ca. 93102
(805) 564-5551

Cc: Santa Barbara Flood Control
City floodplain file
City street file

ATTACHMENT B

A PORTION OF THE "LAGUNA DRAINAGE SYSTEM DESIGN STUDY"



LAGUNA DRAINAGE SYSTEM DESIGN STUDY

December 2001

CLIENT: City of Santa Barbara
Public Works Department

PREPARED BY: Penfield & Smith
101 East Victoria Street
Santa Barbara, California 93101
(805) 963-9532

WORK ORDER NO.: 13868.01

PROJECT MANAGER: Ronald N. Sickafoose, P.E.

REGISTERED PROFESSIONAL ENGINEER
RONALD N. SICKAFOOSE
No. 32187
12.31.04
EXPIRES
CIVIL
STATE OF CALIFORNIA

12-20-01

EXECUTIVE SUMMARY

The Laguna Drainage System collects runoff from over 1800 acres within the City of Santa Barbara. The area in the vicinity of Gutierrez Street, Laguna Street and Calle Cesar Chavez is a historic estuary and portions of this area are only a few feet above the ocean level at high tide. Major storm events during the last 10 years have demonstrated that the system of storm drains, open channel, pumps and ocean release gates is unable to provide the level of flood protection desired by the City.

A variety of improvement options were analyzed as part of this study in an effort to increase the flow capacity of the drainage system and increase the reliability of the Laguna Pump Station Facility. The recommended improvement projects as summarized below accomplish the stated goals. One of the conclusions of the analysis work is that reduction of flood risk to a frequency of 10 years of greater cannot be accomplished with expanded facilities at the Laguna Pump Station. The limited flow capacity of the Laguna Channel and culverts under Highway 101 preclude achieving the desired protection in the area where historical flooding has occurred. It is therefore important that the approved channel maintenance program permitted by the California Department of Fish and Game continue to be a priority.

As an addendum to the original scope of this study, P&S performed a preliminary assessment of the existing storm drains in the Gutierrez Street and Laguna Street area. The problems that were identified include the following:

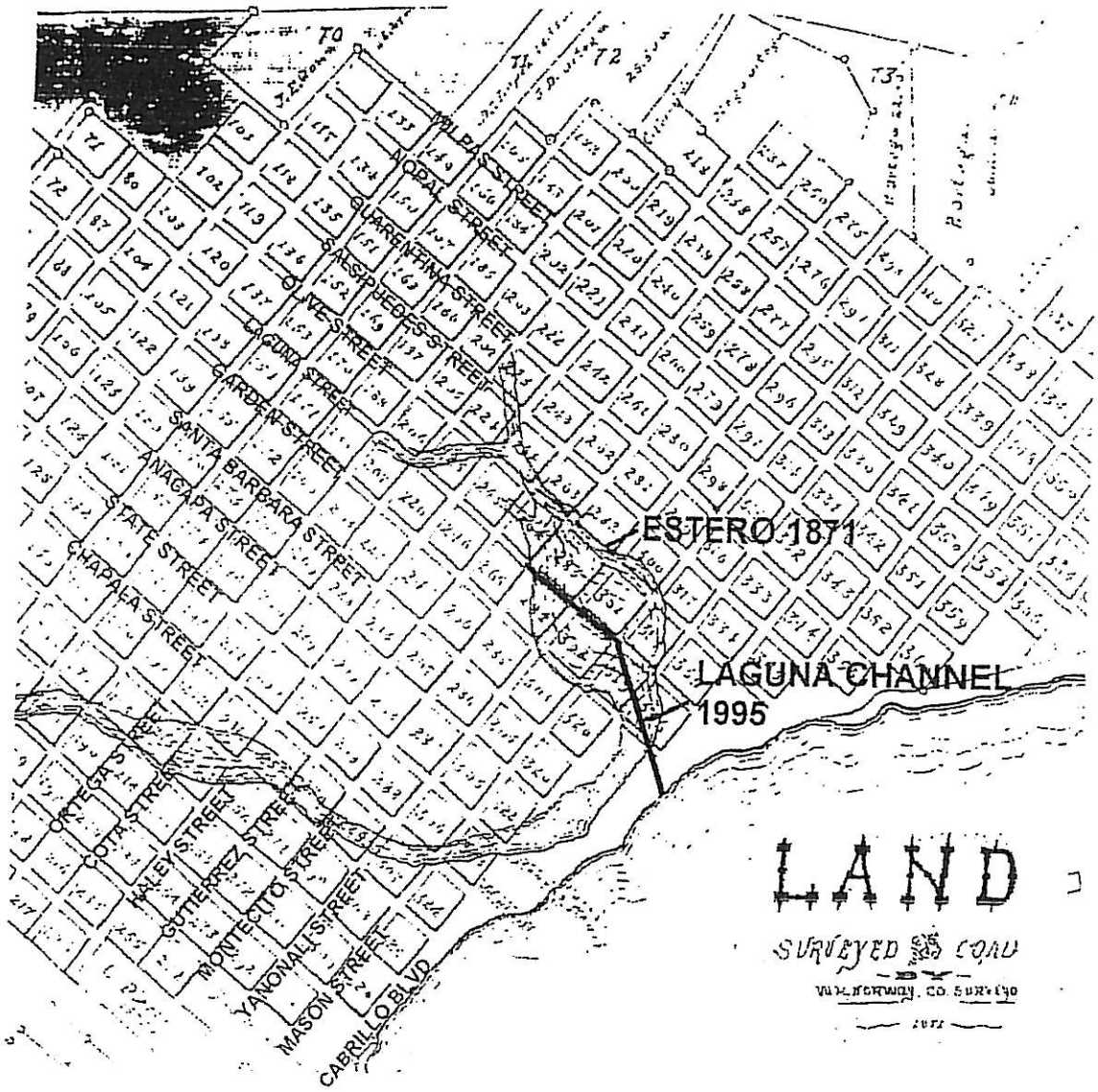
- Large flows running down Laguna Street and other streets that bypass existing catch basins.
- Inadequate inlet capacity at the low point of the watershed.
- Inadequate storm drain capacity in Gutierrez Street.
- Debris clogging of inlets.

Several potential storm drain improvements were identified, including adding catch basins and increasing the size of the collector drains to facilitate delivery of overflow runoff into the major drainage system. The recommended storm drain improvements would be constructed as stand alone project(s) under the City's Capital Improvement Program.

The following list of projects is recommended to be accomplished as funding becomes available. The projects may be combined and phased as necessary. The preliminary budget amounts include costs for construction, design, administration and contingency. Improved flow capacity and system reliability would be provide by upgrading the pumps and storm drain system. The remaining projects would facilitate improved operation and maintenance of the pump station facility and thus improve the efficiency and reliability of flow to the ocean.

DRAINAGE SYSTEM HISTORY

A significant portion of the drainage area overlays an old estuary referred to as El Estero on the 1870 Coast Survey Map shown below. Flooding has occurred in the lower part of the community since development began in the later part of the 19th century. Portions of this area are only a few feet above the ocean level at high tide and effective drainage control is difficult.



Historic Estero Location Map

SYSTEM DESCRIPTION

The Laguna Drainage System includes the following major components:

- Storm Drain System North of Highway 101
- Highway 101 Culverts
- Laguna Channel
- Pump Facility
- Tide Gate Facility

Storm Drain System

The storm drain system for the area north of Highway 101 evolved during the last 100 years as the City developed. The primary confluence of the storm drain system is located within Laguna Street between Gutierrez Street and Highway 101. A single 10 ft by 5 ft. box culvert and a double 62 in. by 54 in. box culvert convey storm water to the upstream side of the Highway 101 Culverts at the south end of Laguna Street.

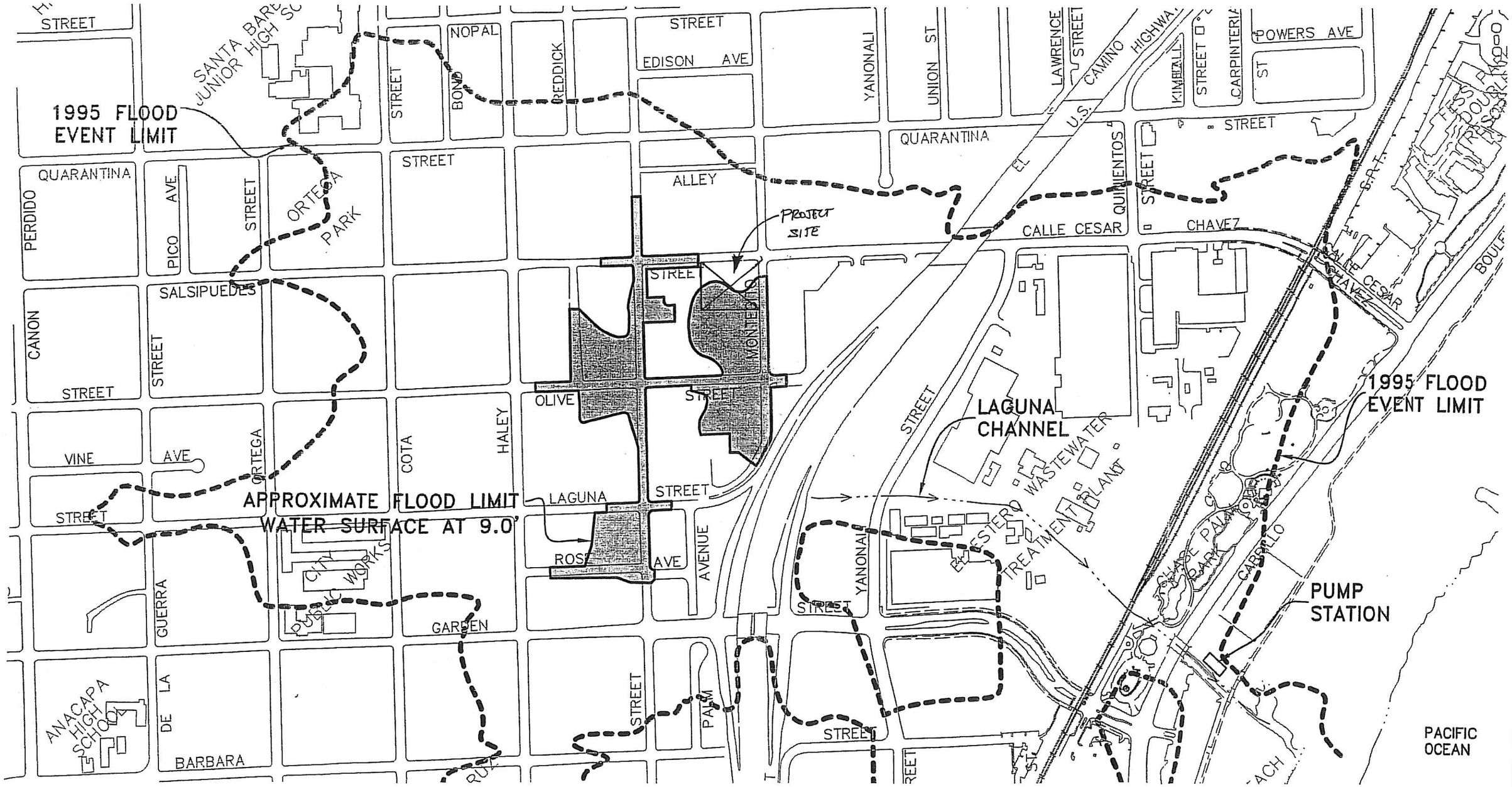
It is typical in such systems to have a mixed level of performance and it is expected that some of the older drain lines and inlets are undersized based on today's conditions and design standards.

During major storm events such as those in 1995, the storm drain system reaches capacity and the local streets serve as overflow channels. Water collects in the historical flood area as shown on Figure 2. To avoid flooding, the local drains must be adequate to receive the overflow water and the downstream facilities must be adequate to convey it once it is received. History shows that this lower part of the system is inadequate at times and therefore, this area is the focus of this report. Figure 3 on the next page shows the major drainage facilities within the study area.

Highway 101 Culverts

The storm drain system north of Highway 101 discharges into several culverts at the highway. The culvert system was upgraded as part of the Cross Town Freeway Project in 1990 and 1991 and includes the following major facilities:

- Laguna Street: Two 10 ft. wide by 6 ft. high culverts
- Montecito Street: One 10 ft. wide by 5 ft. high culvert
- Olive Street: Two 24-inch diameter culverts
- Calle Cesar Chavez: Two 24-inch diameter culverts
One 42-inch diameter culvert



NOTES

1. PLANIMETRY SHOWN FROM TOPOGRAPHIC MAP OF THE CITY OF SANTA BARBARA PREPARED FOR THE CITY OF SANTA BARBARA PUBLIC WORKS DEPARTMENT BY TOWILL, INC. DATED APRIL 10, 1995.
2. 1995 FLOOD EVENT LIMIT FROM LOWER MISSION CREEK FLOOD CONTROL FEASIBILITY STUDY, US ARMY CORP OF ENGINEERS, DECEMBER 1999.

FLOODING AREAS
LAGUNA DRAINAGE SYSTEM
DESIGN STUDY
CITY OF SANTA BARBARA

FIGURE 2

Penfield & Smith
ENGINEERS • SURVEYORS

13868.01 FIG 2.DWG 1"=400'

HYDROLOGY AND HYDRAULICS

Several studies have been prepared in recent years to analyze the hydrology and flood hazards within the Laguna Channel Drainage System. The data generated in the past provided estimates for steady state flow rates for various return periods. In addition, the limits of flooding during the 1995 events were mapped. It is important to note that storm events with intensities that exceed the 10 year return period are likely to have flood flows from Mission Creek entering the lower Laguna system. Such was the case in the Winter of 1995. The proposed Mission Creek improvements currently under review will hopefully minimize the reoccurrence of this flooding scenario.

A summary of the previous studies reviewed and the estimated runoff flow rates is presented below:

Table 1 - Summary of Hydrologic Data

Q_{10} Cfs	Q_{25} cfs	Q_{50} Cfs	Q_{100} cfs	Source
--	880	See Note Below	1,800	Draft Lower Mission Creek Flood Control Feasibility Study, December 1999; US Army Corps of Engineers. Neglects diversion capacity of various area storm drains.
--	1,250	--	--	Cabrillo Bridge Replacement, Hydraulic Analysis Addendum, May 1996; Penfield & Smith
410	1,250	--	--	Laguna Channel Analysis, April 1996, Penfield & Smith. Capacity of storm water pumps determined to be 100 cfs each for a total of 200 cfs maximum pumping rate.
410	1,250	1,960	2,190	Bridge No. 367.83, Santa Barbara; Hydrology and Hydraulics Report, HDR Engineering, Inc., September 1999 for UPRR.

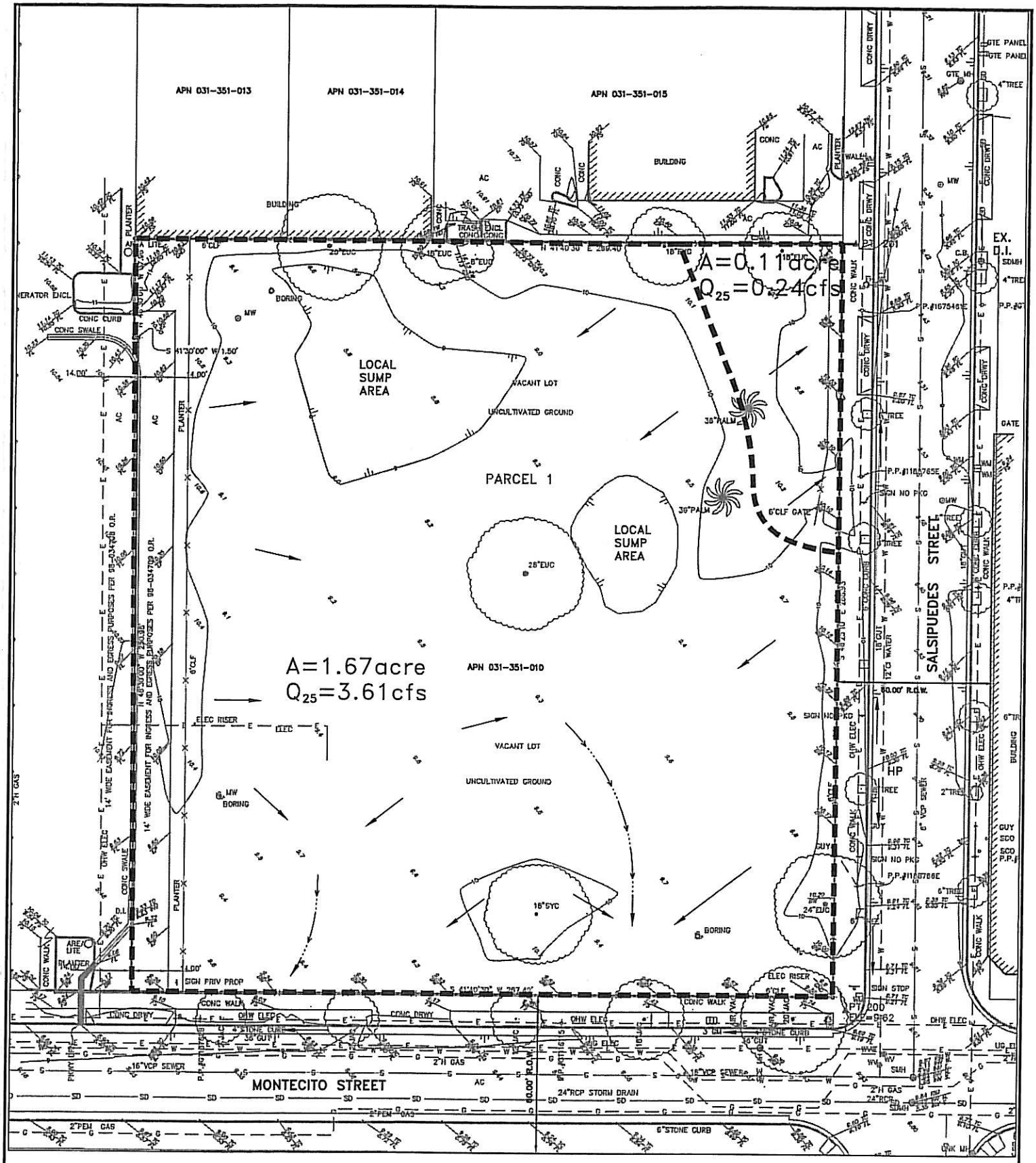
Notes:

1. Based on typical relationships known to occur on the Santa Barbara South Coast, the Q_{50} was assumed to be about 80 percent of the Q_{100}.

In 1997, P&S evaluated the capacity of the pumps and tide gates for various water surface elevation scenarios for channel and beach pond. Based on observations by P&S staff during a range of storm conditions, the elevation of the beach pond typically ranges between 5 feet and 8 feet (NAVD 88). The pumps are usually capable of maintaining the water surface elevation in the channel well below the beach pond water surface elevation. When the channel flow rate exceeds the 200 cfs capacity of the pump station, the water surface elevation in the channel rises to flood stage. When the water surface elevation in the channel is higher than the beach

ATTACHMENT C

HYDROLOGY CALCULATION FOR THE PRE-DEVELOPMENT CONDITION



LAS PORTALES PROJECT
PRE-DEVELOPMENT
DRAINAGE AREA MAP
CITY OF SANTA BARBARA
STATE OF CALIFORNIA
SCALE: 1" = 50' 12/4/06

Penfield & Smith
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W.O. 15783.01 Pre-Post Drainage.dwg

Santa Barbara County Flood Control and Water Conservation District

Program Rational - XL

User Data:

Project Name:	Los Portales	**Project Number:**	15783.03
Date of Run:	12/7/2006	**Run By:**	wff
Notes:	Existing Pre-Development Condition for Los Portales Project (southwesterly portion of site)		

Input Data:

Location:	South Coast	Land Use Type:	Agriculture
Area (Acres):	1.67	Time of Concentration (Min.):	12

	Q10:	Q25:	Q50:	Q100:
Calculated Runnoff Coefficient:	0.62	0.68	0.72	0.74
User Selected Runoff Coefficient (Optional):				

Calculate

For Large Lot Subdivisions (>10,000 sq. ft.):

	Low Value:	High Value:	User Selected:
Q10:			
Q25:			
Q50:			
Q100:			

Enter Selection

Results:

	Rainfall Intensity:	Runoff Coef:	Q (cfs):
Q10:	2.61	0.62	3 2.70
Q25:	3.18	0.68	4 3.61
Q50:	3.68	0.72	4 4.42
Q100:	4.03	0.74	5 4.98

View RI Curves

View RC Curves

Print

Exit

Santa Barbara County Flood Control and Water Conservation District

Program Rational - XL

User Data:

Project Name:	Los Portales	**Project Number:**	15783.03
Date of Run:	12/7/2006	**Run By:**	wff
Notes:	Existing Pre-Development Condition for Los Portales Project (northeasterly portion of site)		

Input Data:

Location:	South Coast	Land Use Type:	Agriculture
Area (Acres):	0.11	Time of Concentration (Min.):	12

	Q10:	Q25:	Q50:	Q100:
Calculated Runnoff Coefficient:	0.62	0.68	0.72	0.74
User Selected Runoff Coefficient (Optional):				

Calculate

For Large Lot Subdivisions (>10,000 sq. ft.):

	Low Value:	High Value:	User Selected:
Q10:			
Q25:			
Q50:			
Q100:			

Enter Selection

Results:

	Rainfall Intensity:	Runoff Coef:	Q (cfs):
Q10:	2.61	0.62	0.18
Q25:	3.18	0.68	0.24
Q50:	3.68	0.72	0.29
Q100:	4.03	0.74	0.33

View RI Curves

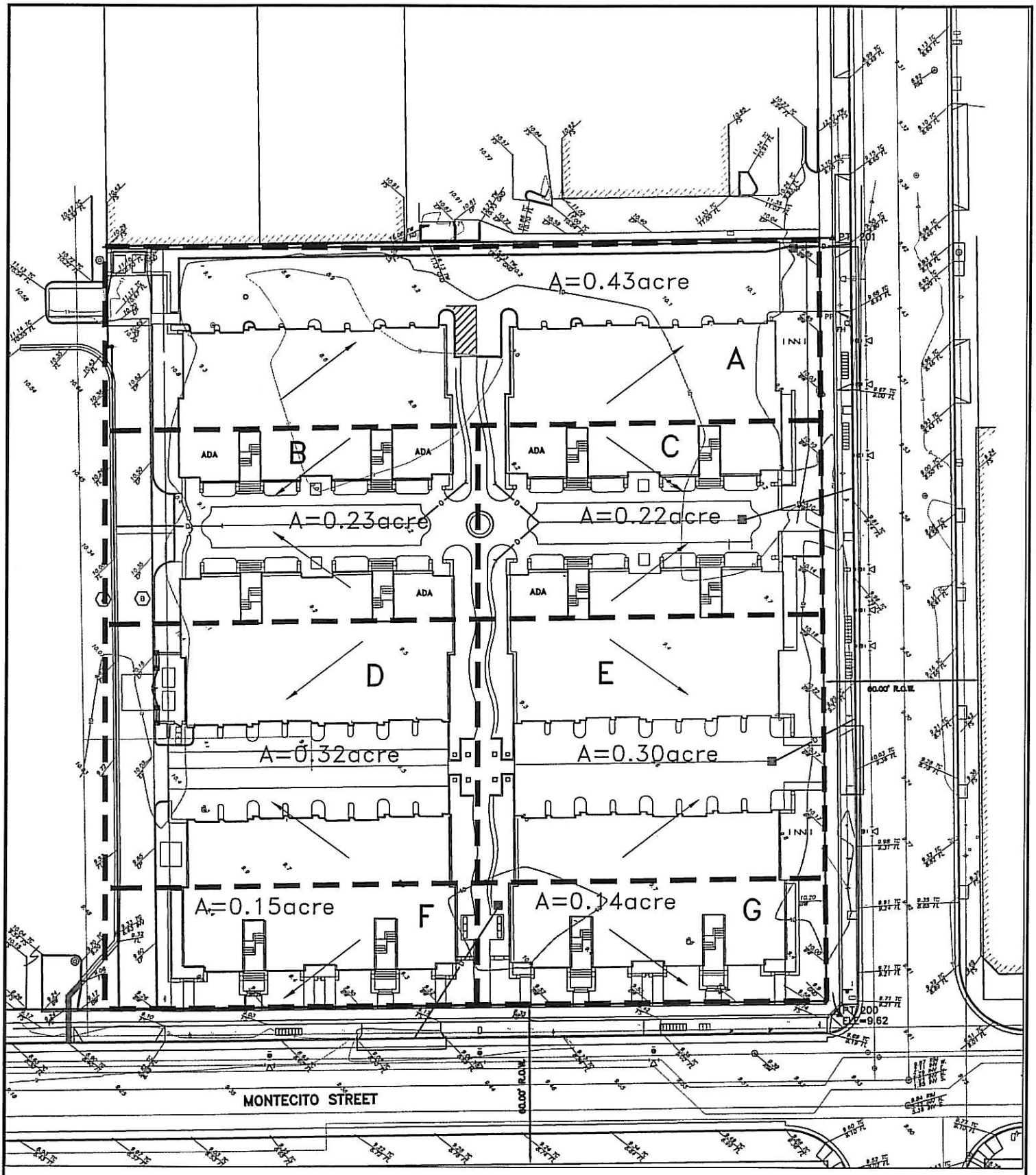
View RC Curves

Print

Exit

ATTACHMENT D

HYDROLOGY CALCULATION FOR THE POST-DEVELOPMENT CONDITION



LAS PORTALES PROJECT
POST-DEVELOPMENT
DRAINAGE AREA MAP
CITY OF SANTA BARBARA
STATE OF CALIFORNIA
SCALE: 1" = 50' 2/22/07

Penfield & Smith
ENGINEERS • SURVEYORS • PLANNERS
W.O. 15783.01 Pre-Post Drainage.dwg

Santa Barbara County Flood Control and Water Conservation District

Program Rational - XL

User Data:

Project Name:	Los Portales	**Project Number:**	15783.04
Date of Run:	12/4/2006	**Run By:**	wff
Notes:	Post-development conditions for Condo units		

Input Data:

Location:	South Coast	Land Use Type:	Condo - Apartments
Area (Acres):	1.78	Time of Concentration (Min.):	12

	Q10:	Q25:	Q50:	Q100:
Calculated Runnoff Coefficient:	0.70	0.74	0.77	0.79
User Selected Runoff Coefficient (Optional):				

Calculate

For Large Lot Subdivisions (>10,000 sq. ft.):

	Low Value:	High Value:	User Selected:
Q10:			
Q25:			
Q50:			
Q100:			

Enter Selection

Results:

	Rainfall Intensity:	Runoff Coef:	Q (cfs):
Q10:	2.61	0.70	~~3~~ 3.25
Q25:	3.18	0.74	~~4~~ 4.19
Q50:	3.68	0.77	~~5~~ 5.04
Q100:	4.03	0.79	~~6~~ 5.67

View RI Curves

View RC Curves

Print

Exit

SITE DETENTION ANALYSIS

PURPOSE OF REPORT

The purpose of this report is to address the concerns of the of the City of Santa Barbara for the Los Portales project regarding peak flow of runoff and overall volume of runoff from the project site compared to the pre-project condition.

BACKGROUND

In the DART review letter, City staff has indicated the need to implement the following requirements (regarding Santa Barbara City Storm Water Management Plan) at the project site:

- retain or treat the ΔQ_{25} on site by the use of landscape features or holding tanks.
- provide volumetric or flow-based treatment control design per published standards.
- capture and treat the amount of runoff from the project site for a 1 inch storm event over 24 hours.

The applicant modified the project plans to incorporate stormwater treatment by use of on-site landscaped swales and catchbasin inserts. In a meeting with City staff to review the project changes, the applicant indicated that on-site detention or recharge would not be effective at this site due to overall, general inundation of the project region even during small rainfall events, very poor site soils which have very low recharge capabilities and have high liquefaction potential, and the inability to drain the site by gravity from an below-grade basin or tank. The City staff agreed that these conditions exist but that the project would need to make additional efforts to address the project requirements. They suggested the following ideas:

- For the soils required to be imported for raising the site and general earthwork, use more pervious soils than are currently on the site.
- Try capturing a reasonable amount of the storm flow in above-ground tanks and investigate below-ground tanks.

APPROACH

The applicant's team discussed the various approaches and were hesitant to make use of above-ground tanks due to the potential for saturation of building walls and soils. Therefore, Penfield & Smith began an investigation of an underground tank. Of necessity, the tank would need to be emptied via pump but could be designed such that if the pump failed, the overflow could be discharged from the property without harm to the residents.

The SB County-recommended approach to detention calculations was applied. This involved the HydroCAD software with County-dictated parameters to determine both flow rate and volume of runoff. The results of the analysis will necessarily differ from those figures provided in the previous calculations using the Rational Method. The following assumptions were made:

- A minimum time of concentration of 12 minutes was used for all calculations.
- A pre-project Curve Number of 94 representing Type D soils (very little infiltration) with open, fairly recently graded features.

- A post-project Curve Numbers ranging from 94 to 98 representing Type C soils (moderate infiltration) with development ranging from Urban Commercial (85% impervious) to Paved Parking Lots and Roofs.
- The use of a 5 ft diameter buried tank in which the length would be varied to accommodate the volume required.
- The use of a sump pump with a discharge rate of 5 gallons per minute. The pump would begin operating as soon as there is water in the tank. It would discharge to an inlet equipped with a stormwater filter.

The site was divided up into drainage watersheds as shown on the attached exhibit. The pre-project and post-project peak flow rates and volumes were calculated. Then underground tank was introduced into the model and the length was varied to obtain the desired results.

RESULTS

Given this approach, the 5 ft diameter tank was varied in length. Using a length of 140 feet, the following results were determined, which provides for a peak post-project 25-year discharge of less than the pre-project 25-year discharge. It also reduces overall runoff volume during a 24-hour period significant and meters the remaining flow out over the period of 2 to 3 days.

Table 1summarizes the results for peak flow rates and Table 2 summarizes the results for volume of runoff.

Table 1 - 25-year Flow Rate Results

Watershed	Area	Pre-Project Flow Rate	Post-Project Flow Rate (without detention)	Post-Project Flow Rate (with detention)
	sf	cfs	cfs	cfs
A	18,731	na	1.45	1.45
B	10,019	na	0.72	Combined with D and routed through tank
C	9,583	na	0.69	.69
D	13,939	na	1.08	1.63
E	13,068	na	1.01	1.01
F	6,534	na	0.47	.47
G	6,098	na	0.44	.44
Total	***77,972***	***5.84***	***5.86***	***5.69***

Table 2 - 25-Year Volume after 24 Hours

Watershed	Pre-Project Volume	Post-Project Volume (without detention)	Post-Project Volume (with detention)
	cf	cf	cf
A	na	10,100	na
B	na	5,030	na
C	na	4,810	na
D	na	7,520	na
E	na	7,050	na
F	na	3,280	na
G	na	3,060	na
Total	***38,990***	***40,850***	***32,550***

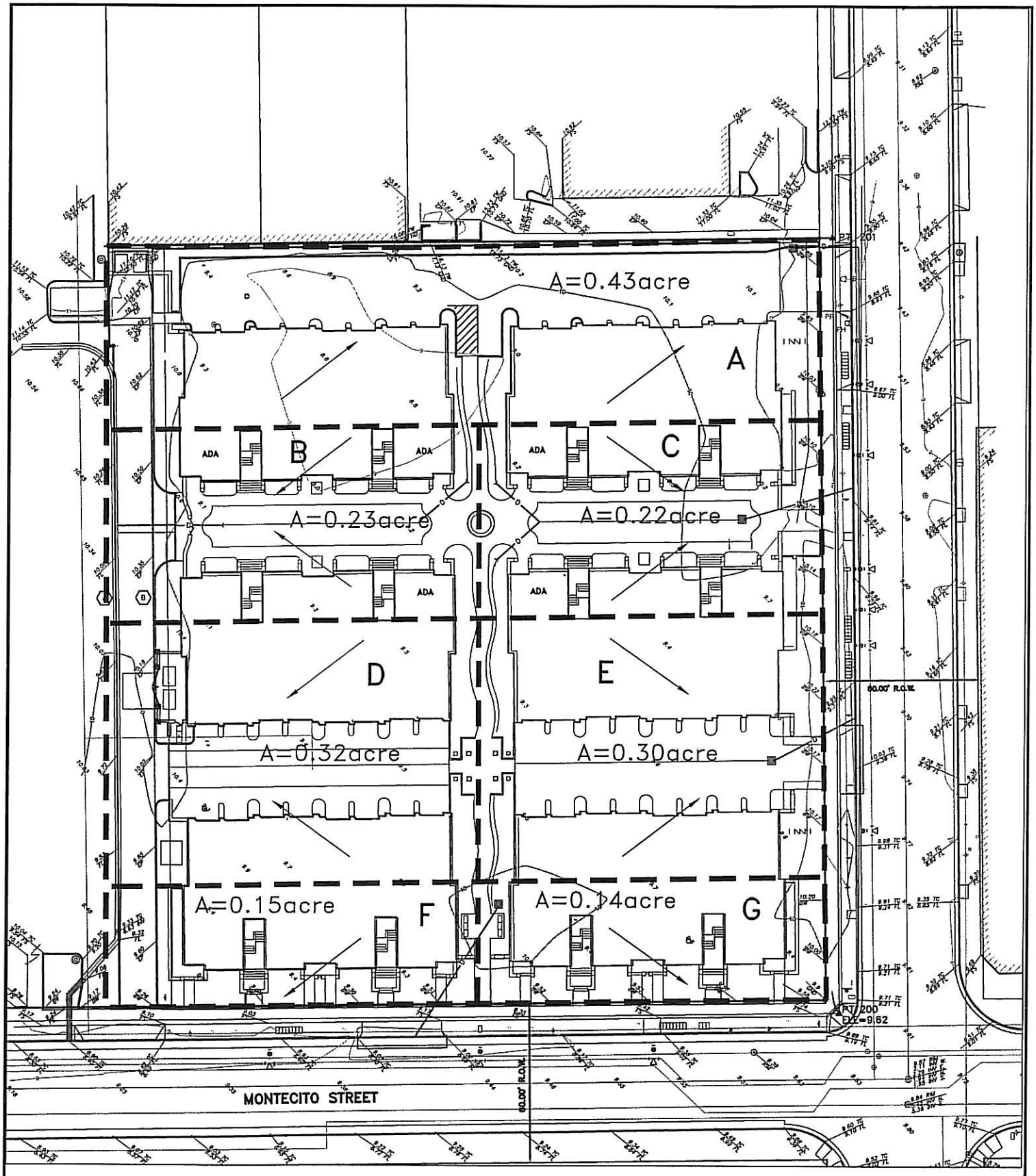
* Note that entire volume will be pumped out over 2 to 3 days

CONCLUSION

Since this solution:

- has reduced the post-project peak 25-year flow rate to less than and pre-project 25-year peak flow rate and
- has reduced the post-project 25-year storm volume to less than the pre-project during the 24-hour storm period and
- has proposed to treat storm water from 98 percent of the site area either by vegetative filtration or catchbasin filter inserts,

It appears to meet the City criterion for Santa Barbara Storm Water Management Plan.



LAS PORTALES PROJECT
POST-DEVELOPMENT
DRAINAGE AREA MAP
CITY OF SANTA BARBARA
STATE OF CALIFORNIA
SCALE: 1" = 50' 2/22/07

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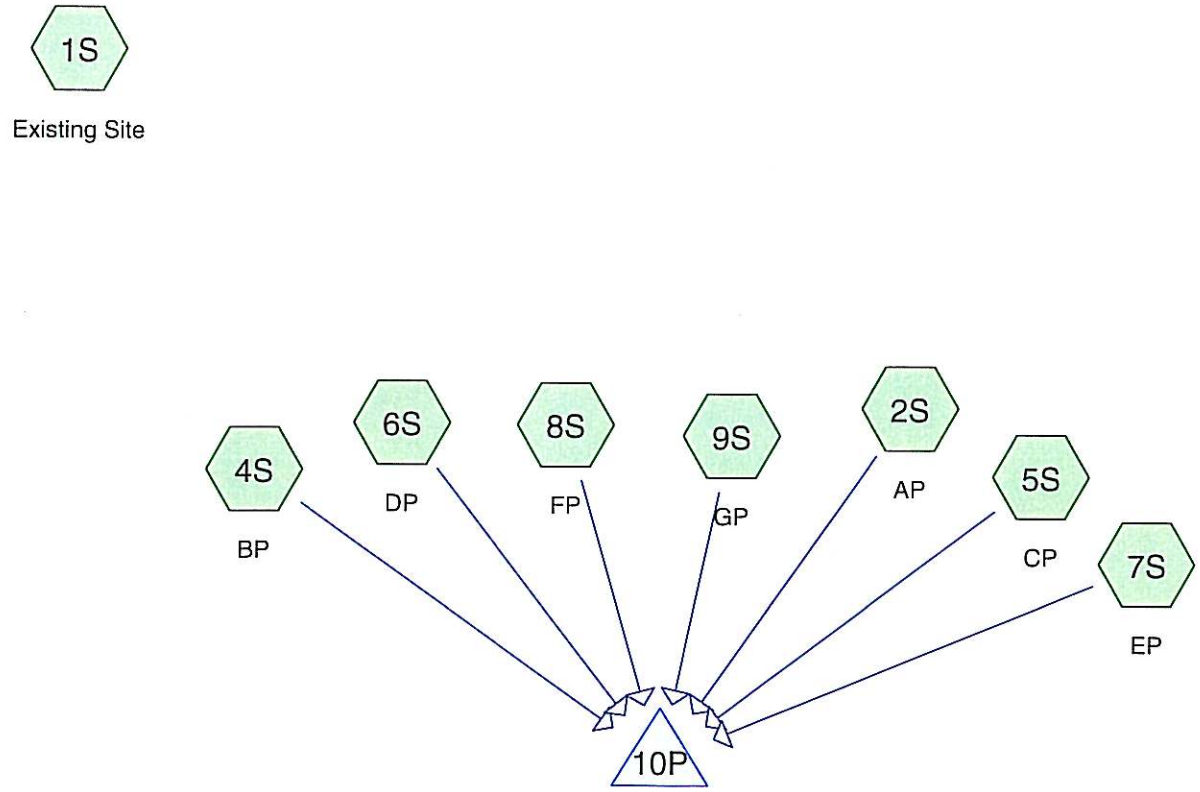
ENGINEERS • SURVEYORS • PLANNERS
W.O. 15783.01 Pre-Post Drainage.dwg



Subcat Reach Pond Link

Drainage Diagram for Unmitigated
Prepared by Penfield & Smith 2/22/2007

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcats)
77,972	94	Newly graded area, HSG D (1S)
32,234	94	Urban commercial, 85% imp, HSG C (4S,5S,8S,9S)
27,007	98	Paved parking & roofs (6S,7S)
18,731	98	Paved roads w/curbs & sewers (2S)
155,945		

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Site Runoff Area=1.790 ac Runoff Depth=6.00"
Tc=12.0 min CN=94/0 Runoff=5.84 cfs 38,989 cf

Subcatchment 2S: AP Runoff Area=18,731 sf Runoff Depth=6.47"
Tc=12.0 min CN=0/98 Runoff=1.45 cfs 10,101 cf

Subcatchment 4S: BP Runoff Area=0.230 ac Runoff Depth=6.02"
Tc=12.0 min CN=71/98 Runoff=0.72 cfs 5,028 cf

Subcatchment 5S: CP Runoff Area=0.220 ac Runoff Depth=6.02"
Tc=12.0 min CN=71/98 Runoff=0.69 cfs 4,810 cf

Subcatchment 6S: DP Runoff Area=0.320 ac Runoff Depth=6.47"
Tc=12.0 min CN=0/98 Runoff=1.08 cfs 7,517 cf

Subcatchment 7S: EP Runoff Area=0.300 ac Runoff Depth=6.47"
Tc=12.0 min CN=0/98 Runoff=1.01 cfs 7,047 cf

Subcatchment 8S: FP Runoff Area=0.150 ac Runoff Depth=6.02"
Tc=12.0 min CN=71/98 Runoff=0.47 cfs 3,279 cf

Subcatchment 9S: GP Runoff Area=0.140 ac Runoff Depth=6.02"
Tc=12.0 min CN=71/98 Runoff=0.44 cfs 3,061 cf

Total Runoff Area = 155,945 sf Runoff Volume = 79,832 cf Average Runoff Depth = 6.14"
53.10% Pervious Area = 82,808 sf 46.90% Impervious Area = 73,137 sf

Subcatchment 1S: Existing Site

Runoff = 5.84 cfs @ 9.98 hrs, Volume= 38,989 cf, Depth= 6.00"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type I 24-hr 25-yr SC Rainfall=6.71"

Area (ac)	CN	Description
1.790	94	Newly graded area, HSG D
1.790	94	Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 2S: AP

Runoff = 1.45 cfs @ 9.98 hrs, Volume= 10,101 cf, Depth= 6.47"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type I 24-hr 25-yr SC Rainfall=6.71"

Area (sf)	CN	Description
18,731	98	Paved roads w/curbs & sewers
18,731	98	Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 4S: BP

Runoff = 0.72 cfs @ 9.98 hrs, Volume= 5,028 cf, Depth= 6.02"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type I 24-hr 25-yr SC Rainfall=6.71"

Area (ac)	CN	Description
0.230	94	Urban commercial, 85% imp, HSG C
0.034	71	Pervious Area
0.195	98	Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 5S: CP

Runoff = 0.69 cfs @ 9.98 hrs, Volume= 4,810 cf, Depth= 6.02"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type I 24-hr 25-yr SC Rainfall=6.71"

Area (ac)	CN	Description
0.220	94	Urban commercial, 85% imp, HSG C
0.033	71	Pervious Area
0.187	98	Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 6S: DP

Runoff = 1.08 cfs @ 9.98 hrs, Volume= 7,517 cf, Depth= 6.47"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type I 24-hr 25-yr SC Rainfall=6.71"

Area (ac)	CN	Description
0.320	98	Paved parking & roofs
0.320	98	Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 7S: EP

Runoff = 1.01 cfs @ 9.98 hrs, Volume= 7,047 cf, Depth= 6.47"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type I 24-hr 25-yr SC Rainfall=6.71"

Area (ac)	CN	Description
0.300	98	Paved parking & roofs
0.300	98	Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 8S: FP

Runoff = 0.47 cfs @ 9.98 hrs, Volume= 3,279 cf, Depth= 6.02"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type I 24-hr 25-yr SC Rainfall=6.71"

Area (ac)	CN	Description
0.150	94	Urban commercial, 85% imp, HSG C
0.023	71	Pervious Area
0.127	98	Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

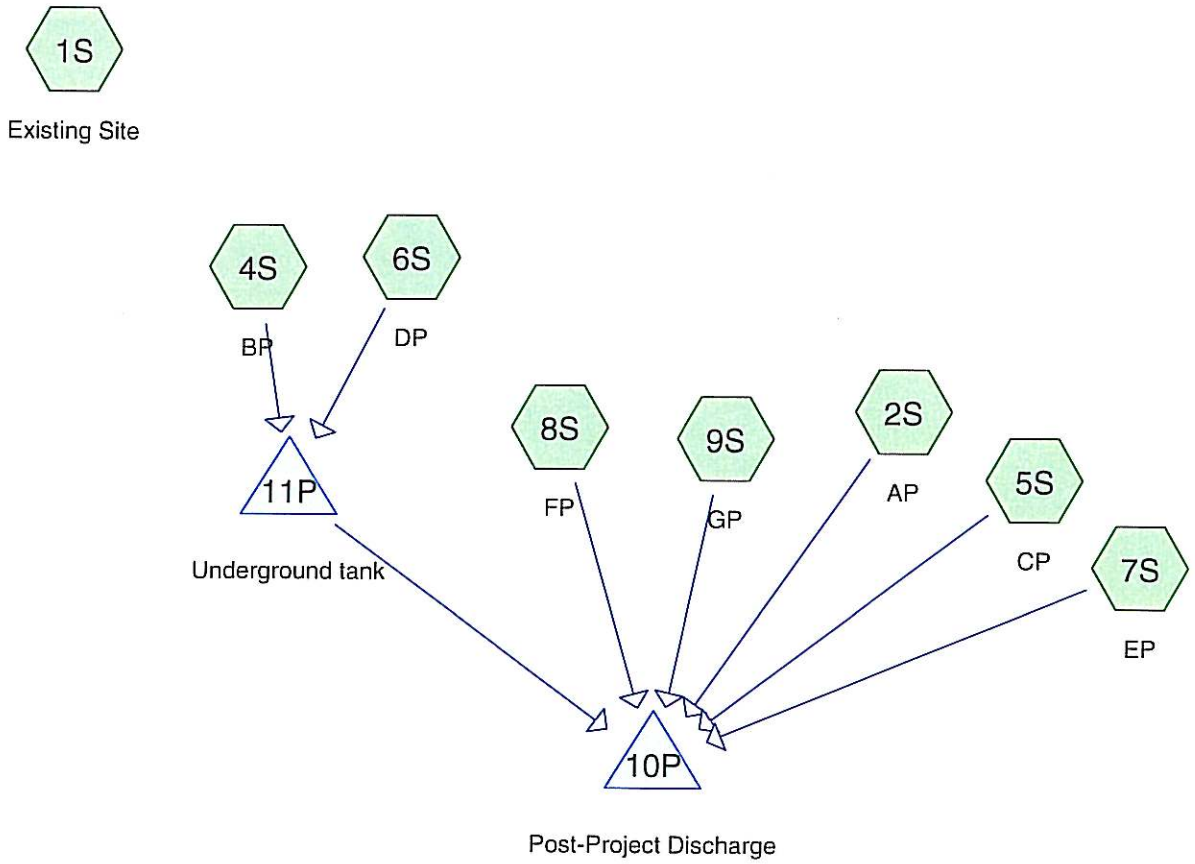
Subcatchment 9S: GP

Runoff = 0.44 cfs @ 9.98 hrs, Volume= 3,061 cf, Depth= 6.02"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type I 24-hr 25-yr SC Rainfall=6.71"

Area (ac)	CN	Description
0.140	94	Urban commercial, 85% imp, HSG C
0.021	71	Pervious Area
0.119	98	Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**



Subcat Reach Pond Link

Drainage Diagram for Underground Storage
Prepared by Penfield & Smith 2/22/2007

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcats)
77,972	94	Newly graded area, HSG D (1S)
32,234	94	Urban commercial, 85% imp, HSG C (4S,5S,8S,9S)
27,007	98	Paved parking & roofs (6S,7S)
18,731	98	Paved roads w/curbs & sewers (2S)
155,945		

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Site Runoff Area=1.790 ac Runoff Depth>5.98"
Tc=12.0 min CN=94/0 Runoff=5.84 cfs 38,873 cf

Subcatchment 2S: AP Runoff Area=18,731 sf Runoff Depth>6.45"
Tc=12.0 min CN=0/98 Runoff=1.45 cfs 10,073 cf

Subcatchment 4S: BP Runoff Area=0.230 ac Runoff Depth>6.01"
Tc=12.0 min CN=71/98 Runoff=0.72 cfs 5,014 cf

Subcatchment 5S: CP Runoff Area=0.220 ac Runoff Depth>6.01"
Tc=12.0 min CN=71/98 Runoff=0.69 cfs 4,796 cf

Subcatchment 6S: DP Runoff Area=0.320 ac Runoff Depth>6.45"
Tc=12.0 min CN=0/98 Runoff=1.08 cfs 7,496 cf

Subcatchment 7S: EP Runoff Area=0.300 ac Runoff Depth>6.45"
Tc=12.0 min CN=0/98 Runoff=1.01 cfs 7,028 cf

Subcatchment 8S: FP Runoff Area=0.150 ac Runoff Depth>6.01"
Tc=12.0 min CN=71/98 Runoff=0.47 cfs 3,270 cf

Subcatchment 9S: GP Runoff Area=0.140 ac Runoff Depth>6.01"
Tc=12.0 min CN=71/98 Runoff=0.44 cfs 3,052 cf

Total Runoff Area = 155,945 sf Runoff Volume = 79,601 cf Average Runoff Depth = 6.13"
53.10% Pervious Area = 82,808 sf 46.90% Impervious Area = 73,137 sf

Subcatchment 1S: Existing Site

Runoff = 5.84 cfs @ 9.98 hrs, Volume= 38,873 cf, Depth> 5.98"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type I 24-hr 25-yr SC Rainfall=6.71"

Area (ac)	CN	Description
1.790	94	Newly graded area, HSG D
1.790	94	Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 2S: AP

Runoff = 1.45 cfs @ 9.98 hrs, Volume= 10,073 cf, Depth> 6.45"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type I 24-hr 25-yr SC Rainfall=6.71"

Area (sf)	CN	Description
18,731	98	Paved roads w/curbs & sewers
18,731	98	Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 4S: BP

Runoff = 0.72 cfs @ 9.98 hrs, Volume= 5,014 cf, Depth> 6.01"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type I 24-hr 25-yr SC Rainfall=6.71"

Area (ac)	CN	Description
0.230	94	Urban commercial, 85% imp, HSG C
0.034	71	Pervious Area
0.195	98	Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 5S: CP

Runoff = 0.69 cfs @ 9.98 hrs, Volume= 4,796 cf, Depth> 6.01"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type I 24-hr 25-yr SC Rainfall=6.71"

Area (ac)	CN	Description
0.220	94	Urban commercial, 85% imp, HSG C
0.033	71	Pervious Area
0.187	98	Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 6S: DP

Runoff = 1.08 cfs @ 9.98 hrs, Volume= 7,496 cf, Depth> 6.45"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type I 24-hr 25-yr SC Rainfall=6.71"

Area (ac)	CN	Description
0.320	98	Paved parking & roofs
0.320	98	Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 7S: EP

Runoff = 1.01 cfs @ 9.98 hrs, Volume= 7,028 cf, Depth> 6.45"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type I 24-hr 25-yr SC Rainfall=6.71"

Area (ac)	CN	Description
0.300	98	Paved parking & roofs
0.300	98	Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 8S: FP

Runoff = 0.47 cfs @ 9.98 hrs, Volume= 3,270 cf, Depth> 6.01"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type I 24-hr 25-yr SC Rainfall=6.71"

Area (ac)	CN	Description
0.150	94	Urban commercial, 85% imp, HSG C
0.023	71	Pervious Area
0.127	98	Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 9S: GP

Runoff = 0.44 cfs @ 9.98 hrs, Volume= 3,052 cf, Depth> 6.01"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type I 24-hr 25-yr SC Rainfall=6.71"

Area (ac)	CN	Description
0.140	94	Urban commercial, 85% imp, HSG C
0.021	71	Pervious Area
0.119	98	Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Pond 10P: Post-Project Discharge

Inflow Area = 77,973 sf, Inflow Depth > 5.01" for 25-yr SC event
Inflow = 5.70 cfs @ 9.98 hrs, Volume= 32,554 cf
Primary = 5.70 cfs @ 9.98 hrs, Volume= 32,554 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Pond 11P: Underground tank

Inflow Area = 23,958 sf, Inflow Depth > 6.27" for 25-yr SC event
Inflow = 1.80 cfs @ 9.98 hrs, Volume= 12,510 cf
Outflow = 1.63 cfs @ 9.98 hrs, Volume= 4,337 cf, Atten= 10%, Lag= 0.0 min
Primary = 1.63 cfs @ 9.98 hrs, Volume= 4,337 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 9.82' @ 9.98 hrs Surf.Area= 0 sf Storage= 2,749 cf

Plug-Flow detention time= 185.7 min calculated for 4,328 cf (35% of inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	2,749 cf	**60.0"D x 140.00'L Horizontal Cylinder S= 0.0050 '/'**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**Pump** Elev. (feet) 0.00 0.01 9.70 Disch. (cfs) 0.000 0.010 0.010
#2	Primary	9.70'	**15.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=1.54 cfs @ 9.98 hrs HW=9.82' (Free Discharge)
↑—**1=Pump** (Custom Controls 0.01 cfs)
└—**2=Broad-Crested Rectangular Weir** (Weir Controls 1.53 cfs @ 0.86 fps)

STORM WATER QUALITY ANALYSIS

Stormwater Treatment at the Los Portales Project

Location: 583 E. Montecito Street

Setting: The project site is1.78 acres. The proposed project will create approximately 1.42 acres (or 80% of the total site) of impervious surface including building, driveway and walkway, etc., and the remaining approximately 0.36 acre (or 20% of the total site) will be landscaped and open space area.

The proposed site stormwater treatment could be generally divided into the following 3 categories: Stormwater receiving surface treatment (i.e. swale and landscaping) is approximately 1.23 acres (or 69% of the total site); receiving mechanical treatment (i.e. catch basin insert) is approximately 0.51 acre (or 29% of the total site); and receiving no treatment is approximately 0.04 acre (or 2% of the total site).

Proposed storm water treatment Analysis (see enclosed calculations):

The analysis first calculates the required stormwater treatment quantity by referencing the Ventura County Technical Guidance Manual for Stormwater Quality Control Measures (it is normally a more conservative analysis), and California Stormwater Quality Association Stormwater Best Management Practice Handbook (for rainfall intensity at 85%). It resulted in 0.5 cubic feet per second (cfs) and 0.15 cfs required treatment runoff respectively. This analysis used 0.5 cfs for required stormwater treatment quantity.

There are 2 similarly sized vegetated swales plus several smaller landscape strips within the project site. This analysis calculated the contact time for one of the swales by using the 0.5 cfs of the required treatment flow. It resulted in 7.08 minutes of contact time, which is greater than the minimum required contact time of 7 minutes.

Conclusion: The proposed site development will provide sufficient stormwater treatment before discharging runoff off-site.

Santa Barbara County Flood Control and Water Conservation District

Program Rational - XL

User Data:

Project Name:	Montecito Street	**Project Number:**	15783.04
Date of Run:	2/7/2007	**Run By:**	BTF/SCW
Notes:			

Input Data:

Location:	South Coast	Land Use Type:	Condo - Apartments
Area (Acres):	1.78	Time of Concentration (Min.):	12

	Q10:	Q25:	Q50:	Q100:
Calculated Runnoff Coefficient:	0.70	0.74	0.77 ✓	0.79
User Selected Runoff Coefficient (Optional):				

Calculate

For Large Lot Subdivisions (>10,000 sq. ft.):

	Low Value:	High Value:	User Selected:
Q10:			
Q25:			
Q50:			
Q100:			

Enter Selection

Results:

	Rainfall Intensity:	Runoff Coef:	Q (cfs):
Q10:	2.61	0.70	3
Q25:	3.18	0.74	4
Q50:	3.68 ✓	0.77	5
Q100:	4.03	0.79	6

View RI Curves | Print | View RC Curves | Exit

CALCULATE TREATMENT Q.

1) $0.1 \times Q_{P50} = 0.1\,C\,I\,A = .1\,(.77)\,(3.68)\,(1.78) = 0.50$ cfs (GOVERN) ✓

PER VENTURA COUNTY TECHNICAL GUIDANCE MANUAL FOR STORM WATER QUALITY CONTROL Measures.

2) FLOW BASED BMP PER CA. STORMWATER BMP HANDBOOK

$Q = C \cdot I \cdot A$; $i = 0.14$ IN/HR, OXNARD EQUIPMENT YARD, CUMULATIVE FREQUENCY HOURLY RAINFALL INTENSITY AT 85%

$C = 0.858\, i_R^3 - 0.78\, i_R^2 + 0.774\, i_R + 0.04$, i_R = IMPREVIOUS RATIO

$= 0.858 \cdot (.8)^3 - 0.78\,(0.8)^2 + 0.774\,(0.8) + 0.04$

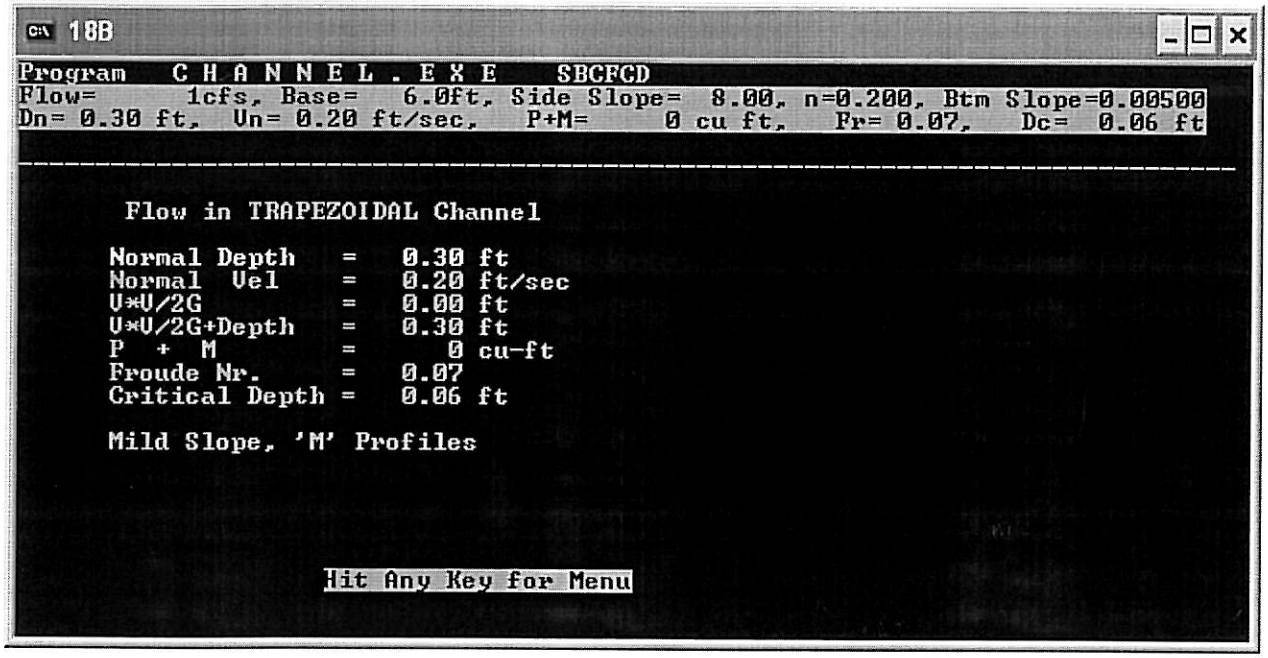
$= 0.44 - 0.50 + 0.62 + 0.04$

$= 0.60$

$Q = (0.6)(0.14)(1.78) = 0.15$ cfs

USE STANDARD SAFETY FACTOR OF 2 ⇒ $Q = 0.30$ cfs < 0.50 cfs (THE ABOVE VENTURA COUNTY METHOD)

ONE OF THE SITE SWALE. DESIGN DATA.



Penfield & Smith

By _____ Date 2/7/07

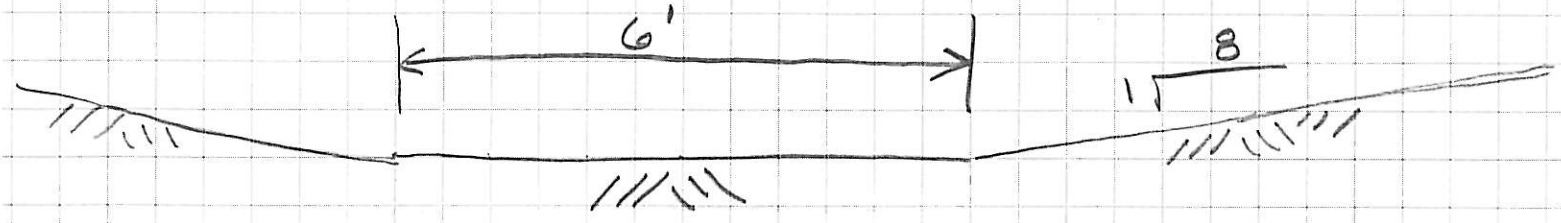
Ck. By _____ W.O. No. 1578.04

WATER QUALITY CALC

Sheet _____ of _____

Santa Barbara • Camarillo • Santa Maria • Lancaster

$A = 1.78$ AC
$Q = 0.50$ CFS
$n = 0.20$
$S = 0.005$



FROM OPEN CHANNEL FLOW ANALYSIS:

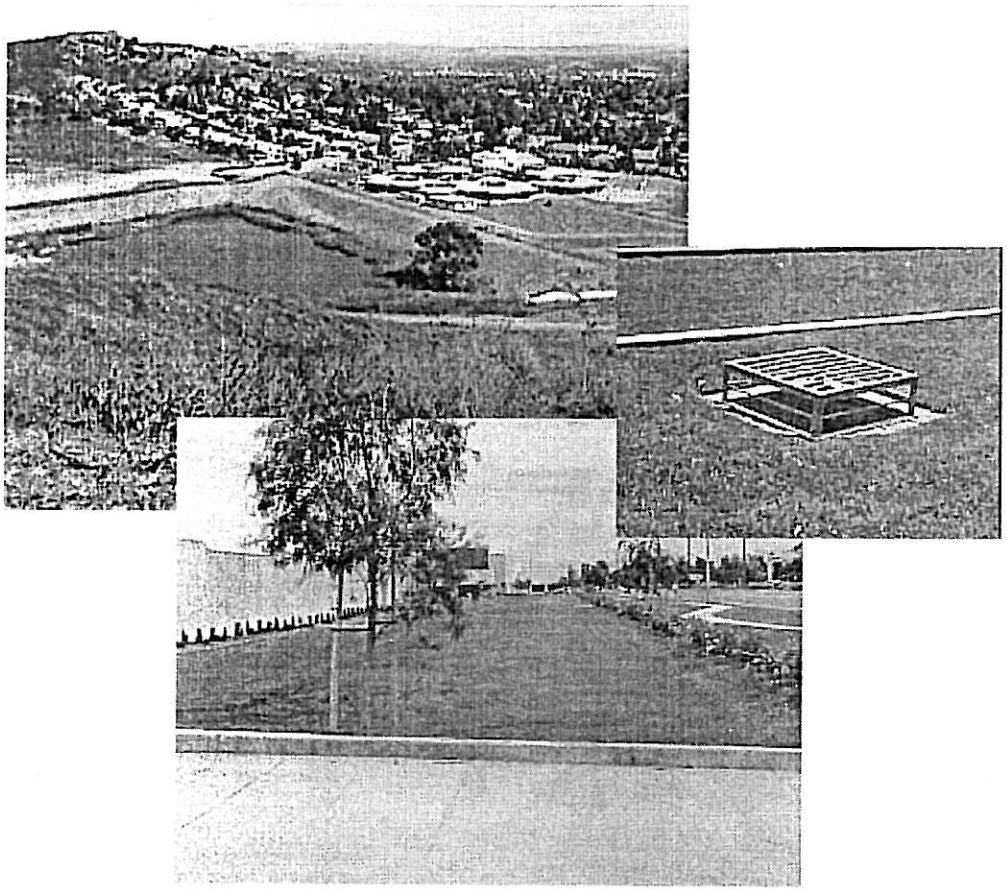
$d = 0.30$ FT $= 3.6$ IN OK $(3 < d < 5)$

$V = 0.2$ fps OK $(V < 2.0$ fps$)$

$\ell = 85$ FT (LENGTH OF SWALE)

CONTACT TIME $= \dfrac{85 \text{ ft}}{60(.20 \text{ fps})} =$ 7.08 MINUTES > 7 MIN. (O.K.)

Technical Guidance Manual
for
Stormwater Quality Control Measures



July 2002

Ventura Countywide Stormwater Quality Management Program

Pollutant Removal

Relative pollutant removal effectiveness of a GSWF is presented in Table 5-1. Removal effectiveness of GSWF for sediment and particulate forms of metals, nutrients and other pollutants is considered moderate to low. Grass Swale Filters are the least effective of the approved treatment control measures. Consequently, they should generally be used in conjunction with one of the other approved treatment control measures.

Design Criteria and Procedure

Principal design criteria for GSWFs are listed in Table 5-4.

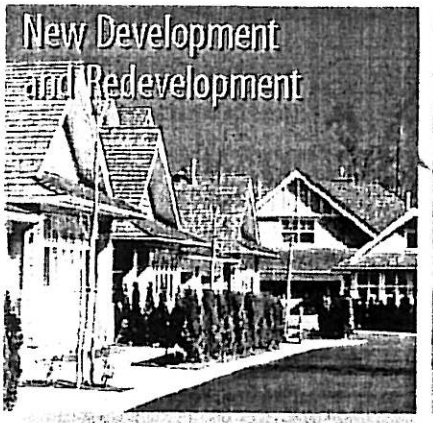
Table 5-4. Grass Swale Filter Design Criteria

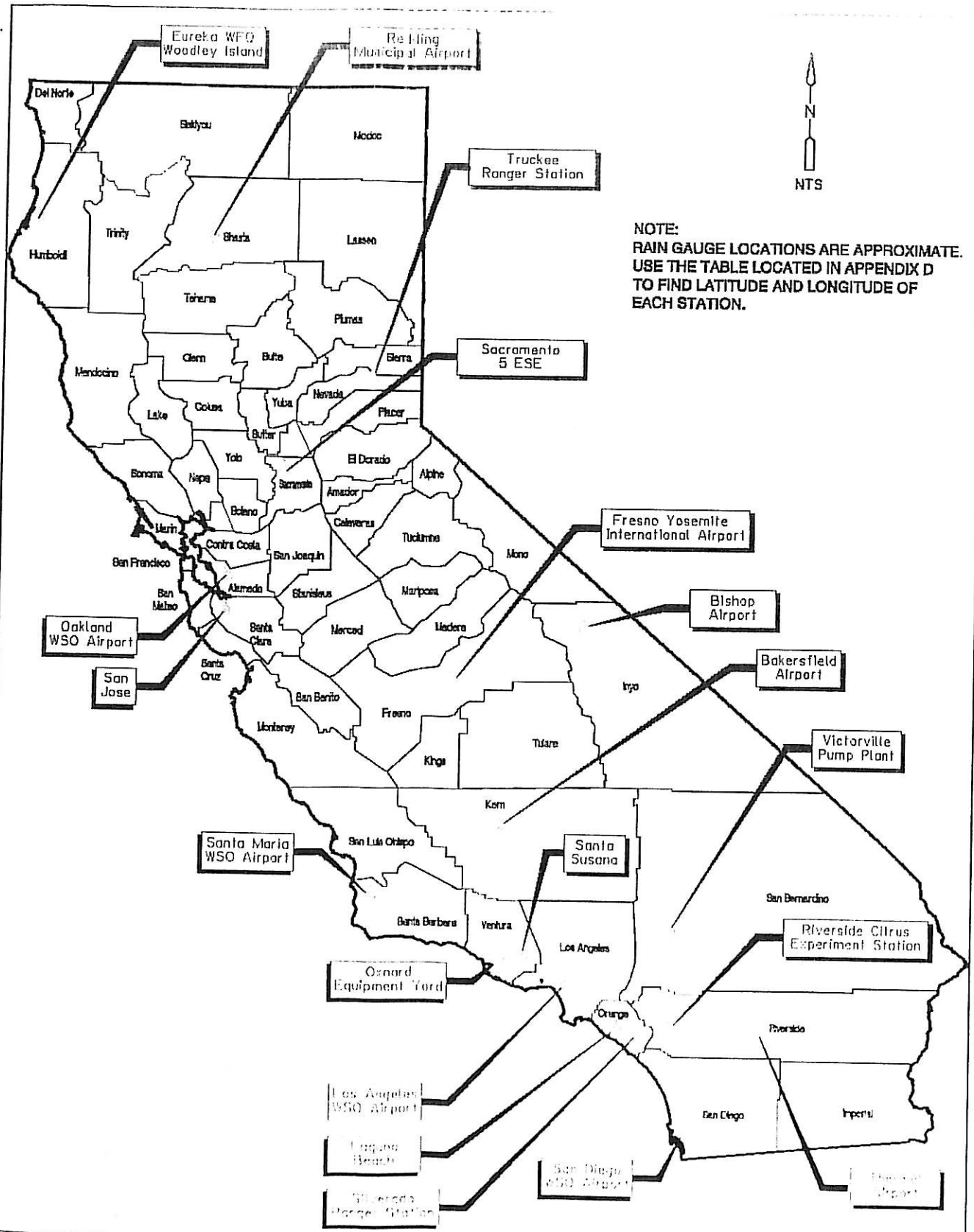
Design Parameter	Unit	Design Criteria
Design Flow (SQDF)	cfs	0.1 x $Q_{P, 50yr}$
Swale geometry	–	Trapezoidal or triangular
Maximum channel side slope	H:V	4 :1
Minimum slope in flow direction	%	0.2 (provide underdrains for slopes < 0.5)
Maximum slope in flow direction	%	2.0 (provide grade-control checks for slopes >2.0)
Maximum flow velocity	ft/sec	1.0 (based on Manning n = 0.20)
Maximum depth of flow at SQDF	inches	3 to 5 (1 inch below top of grass)
Minimum contact time	minutes	7 (provide sufficient length to yield min contact time)
Minimum length	ft	sufficient length to provide minimum contact time
Vegetation	–	Turf grass or approved equal
Grass height	Inches	4 to 6 (mow to maintain height)

California Stormwater Quality Association

Stormwater Best Management Practice Handbook

New Development and Redevelopment

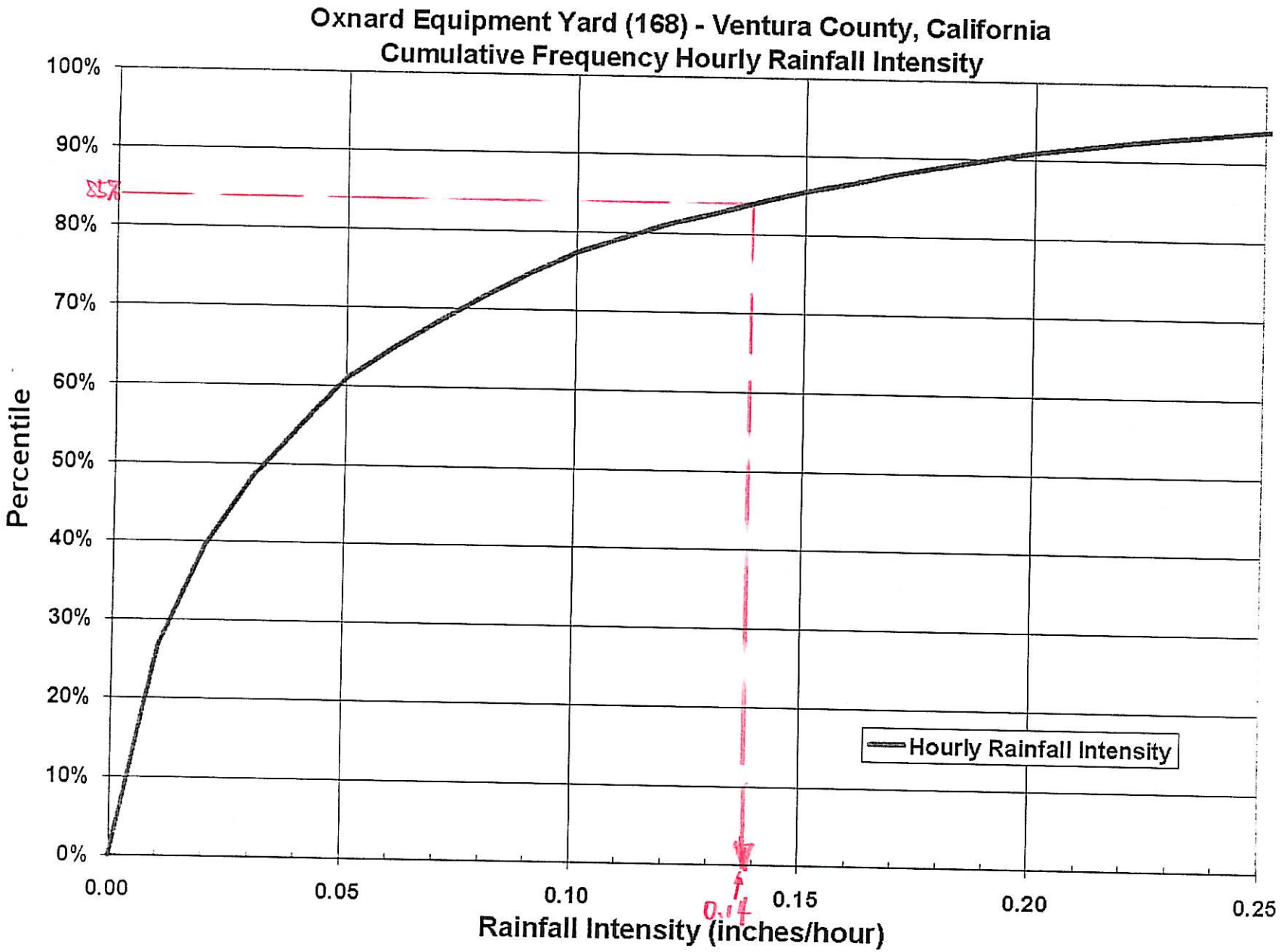




SQA
California Stormwater Quality Association

Selected Rain Gauge Index

Appendix D


Oxnard Equipment Yard (168) - Ventura County, California
Cumulative Frequency Hourly Rainfall Intensity
100%
90%
85%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Percentile
0.00
0.05
0.10
0.14
0.15
0.20
0.25
Rainfall Intensity (inches/hour)
Hourly Rainfall Intensity